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Factors Affecting Peach Tree Longevity in Georgia

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FACTORS AFFECTING PEACH TREE LONGEVITY IN GEORGIA

By
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The short life span of trees is one of the most important economic problems confronting the peach grower in Georgia. This is especially true in the south Georgia peach section† where it is unusual to find orchards 10 or more years of age still having a good stand of trees. In the central Georgia peach section and in the north Georgia peach section trees are much longer-lived. To gain an answer to the underlying causes of the difference in longevity of the trees in the various sections, as well as to evaluate the causes of tree mortality over the entire area, studies were begun in 1930 and continued through 1940. During this period there has been considerable change in the causes of tree losses due to the development and greater use of new materials for combatting insects. For example, the San Jose scale was causing great losses of trees in the early years of these studies as were also borers, but with the more general use of oil emulsion as a dormant spray for scale and more effective control measures for borers, these sources of loss have greatly decreased. Recognizing that these changes were taking place, more extensive studies on longevity were begun in 1937.

MAJOR CAUSES OF TREE LOSSES

During the years in which these studies were made, the life histories of over 40,000 trees were followed in the 3 sections of the Georgia Peach Belt. The various causes which affect the longevity of trees in the different peach-growing sections of Georgia are given in Table 1. The reason for the death of trees listed as missing and replants could, of course, usually not be determined. It is assumed that for the most part such trees would follow the trend on a percentage basis shown by the trees of which the cause of death was determined. In many instances more than one factor caused the death of a given tree. In such cases the cause was assigned to that factor which appeared to be the principal one.

Winter injury. Winter injury is by far the outstanding cause of tree losses on all 3 of the peach-growing sections of the state, though the form of winter injury predominant is not the same in each section. In the ordinary year, winter injury is restricted to 2 forms, that of crown injury and winter sunscald or southwest injury.

Crown injury to peach trees in Georgia results from a lack of maturity of tissues either due to continuous favorable conditions

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†The Peach Belt of Georgia may be divided into 3 major peach sections: namely, the north Georgia peach section centered around Habersham and Banks Counties; the middle Georgia peach section with the center comprised of Meriwether, Spalding, Pike, Upson, and Lamar Counties, and the south Georgia peach section with its center in Peach County. Although some peaches are grown south of Peach County, it may be said that this county is near the southern limit of successful commercial peach production.

TABLE 1
FACTORS CAUSING DEATH OF TREES IN GEORGIA PEACH ORCHARDS

	North Georgia		Central Georgia		South Georgia	
	number	*per cent*	*number*	*per cent*	*number*	*per cent*
Trees 1 to 4 years old, inclusive.						
Total number of trees			9,339	100.00	6,714	100.00
In good condition			8,669	92.83	6,406	95.42
Missing	No orchards		151	1.62	43	0.65
Replants	examined of		291	3.12	228	3.39
Winter Injury	this age		169	1.80	33	0.49
Borers	group		50	0.54	0	0.00
Erosion			0	0.00	0	0.00
Crown gall			0	0.00	3	0.04
Other causes			9	0.09	1	0.01
Trees 5 to 9 years old, inclusive.						
Total number of trees	1,292	100.00	7,477	100.00	4,291	100.00
In good condition	839	64.94	6,604	88.32	2,583	60.20
Missing	237	18.34	96	1.28	351	8.17
Replants	134	10.37	458	6.13	631	14.71
Winter injury	21	1.63	115	1.54	704	16.41
Borers	6	0.46	190	2.54	22	0.51
Erosion	54	4.18	0	0.00	0	0.00
Crown gall	0	0.00	6	0.08	0	0.00
Other causes	1	0.08	8	0.11	0	0.00
Trees 10 years or over.						
Total number of trees	2,298	100.00	3,342	100.00	3,859	100.00
In good condition	1,562	67.97	2,666	79.77	1,850	47.94
Missing	101	4.40	181	5.42	1,218	31.56
Replants	325	14.14	282	8.44	595	15.42
Winter injury	310	13.49	140	4.19	181	4.69
Borers	0	0.00	5	0.15	10	0.26
Erosion	0	0.00	47	1.41	0	0.00
Crown gall	0	0.00	20	0.59	0	0.00
Other causes	0	0.00	1	0.03	5	0.13

for late growth as in the case of young trees, or, what is more common, a partial resumption of growth processes during warm periods just preceding subfreezing temperatures. In south Georgia crown injury is the predominant form of winter injury. The climate of this section is naturally favorable for this type injury. In north Georgia it is not often found, since at these higher altitudes the climate is not conducive to such injury. Partial girdling of the tree due to crown injury often results in the death of the limbs above the girdle. If this does not occur the first year, it will take place within the next year or so since the tree is increasingly susceptible to further winter injury and the attacks of insects and

diseases. The killing of bark well up on the major limbs of a peach tree is often indirectly the result of crown injury. This form of injury has been found quite frequently in some orchards of the middle Georgia peach section.

Winter sunscald is generally attributed to conditions of high temperature during sunny days of winter followed by sudden drops of temperature to below freezing at night. In north Georgia, winter sunscald is quite common, causing serious losses particularly on the southern and southwestern slopes (Figure 1). The differences between southwestern and northeastern slopes in their effect on southwest injury is clearly and strikingly shown in Figures 2 and 3 and Table 2. Insofar as possible in this north Georgia peach section, southwestern slopes should not be planted to peaches. Winter sunscald is not often found in south Georgia, but

FIG. 1. *An advanced case of southwest injury.*

it is quite common in middle Georgia. Under north Georgia conditions, trees even badly injured, if located on fairly level land, continue to live and maintain production, while trees planted on more rolling land with the same amount of injury die rapidly. This evidences that there are other factors complicating the situation rather than its being a simple case of winter injury. In the areas of greater tree losses the slope is more abrupt, making for a much greater runoff of water. On the steeper slopes erosion has reduced the volume of soil into which the roots may penetrate

FIG. 2. *Twenty-seven year old Elberta trees on northern slope in north Georgia peach section still bearing profitable crops.*

TABLE 2
EFFECT OF DIRECTION OF SLOPE ON THE LONGEVITY OF PEACH TREES IN NORTH GEORGIA

	NORTHEAST SLOPE		SOUTHWEST SLOPE	
	number	*per cent*	*number*	*per cent*
Total number of trees	844	100.0	615	100.0
In good condition	802	95.0	208	33.8
Missing	37	4.4	21	3.4
Replants	0	0.0	85	13.8
Winter injury	5	0.6	301	49.0
Borers	0	0.0	0	0.0

easily. Thus, the combination of factors of high percentage runoff of rainfall, less volume of soil to hold water, plus the injured xylem, or wood, which if the injury is severe, is incapable of conducting water, all operate to cause the death of the trees in such locations.

Under the climatic conditions of Georgia, cold injury is not usually associated with immaturity of tissue in the early winter, since lack of rainfall from September through November prevents continuation of growth and excessive cold does not often

FIG. 3. *Orchard on same farm as Fig. 2 but on southwestern slope. Note large numbers of replanted trees.*

occur in November. During the 10 years in which this study was under way, this type of injury occurred but once. On November 16, 1940, the temperature dropped to 18-20° F. over much of the Peach Belt. Peach trees were still in foliage when these temperatures were recorded. As a result, considerable winter injury occurred in the peach orchards of the middle and south Georgia sections. The amount of injury taking place depended upon the maturity of the tissues at the time they were subjected to this low temperature. Young, rapidly growing trees in some orchards were extremely susceptible. In a 2-year-old orchard 1,000 out of 6,000 trees were severely damaged. This injury was not restricted to the crown but was also found well up on the larger branches. Some of the results of this November freeze are shown in Figure 4. Susceptible trees were killed outright, while those more hardy suffered only slight injury.

Rootstocks that are not resistant to cold injury give rise to another form of winter injury which has caused considerable loss of trees in some orchards. Figure 5 shows the rootstock of a tree which has been killed by cold, while the scion is still alive. Winds of quite high velocity in the fall occasionally rock the tree, causing the formation of a pocket in the soil around the tree. The cold air during the winter penetrates into this pocket, causing the death of the stock and subsequently the death of the tree. The selection of hardier, better-type stocks on which to bud the dif-

FIG. 4. *Outright killing of trees following temperature of 18° F. on November 16, 1940. Winter injury associated with immaturity.*

ferent varieties is a practice which will be demanded by better growers to prevent such losses.

Another type of injury, which is not a form of winter injury but is very closely related to it in its effect on trees, is summer sunscald. Summer sunscald occurs in the south and central peach sections with damage to scaffold branches and trunk due to the

FIG. 5. *Rootstock killed by cold; cion wood not injured.*

high temperatures developed by the direct rays of the sun during summer months. This injury results where the trees are so severely pruned that the main branches and trunk are not protected by foliage. It is mentioned at this time to avoid confusion.

PREVENTION OF WINTER INJURY. Once a tree has been winter injured there is little or no cure, especially when the damage is severe. Recent work at this Station (1) has shown that much of this injury can be prevented by complete fertilizer applications sufficient to keep the trees in a vigorous growing condition. The common error of many growers is to apply only enough fertilizer to carry the trees up to the harvest period with little regard for the needs of the tree during the remainder of the growing season. Some growers, especially on lighter soils, have found an application of nitrate of soda in June in addition to the regular spring fertilizer application to be beneficial. Trees which are not weakened by deficiencies of nitrogen or other fertilizer elements are better able to withstand cold injury during the winter months.

PEACH BORERS. Borers do not account for the heavy losses of peach trees that they did in former years. This condition is, no doubt, a result of the development and general use of more effective control measures. Even with these control measures, either because of failure to use or carelessness in application, injury caused by borers is still an important factor affecting longevity. Borers cause more damage to individual trees in the south than in the north Georgia peach section since there is a greater period of the year in south Georgia in which the temperature is high enough that these insects can maintain maximum activity and do more damage over the longer period.

Shot-hole borers are occasionally blamed by growers for the death of peach trees. This insect never attacks vigorously growing trees, but rather trees weakened by winter injury or attacks of the peach borer. This shot-hole borer can be regarded as a sort of secondary invader which continues the damage already started by some other agency.

EROSION. Erosion ranks with or slightly ahead of the peach borer as a cause of tree losses, although it is most difficult to give an estimate of tree loss due to this cause. The data in Table 1 show a much smaller loss due to erosion than from either winter injury or borers, but it is entirely possible that erosion to a slight degree might have predisposed the trees to winter injury by cutting down their vigor. Separation of one of these factors from the other is nearly impossible. A large portion of the commercial Peach Belt of Georgia is characterized by heavy red clay or sandy clay soils through which the roots of the peach penetrate comparatively slowly. If the topsoil through which the roots penetrate most easily is eroded away, the volume of the soil occupied by the roots is quite restricted as is also the length of life of the tree. Eroding of the topsoil is shown in Figure 6. Observations show a remarkable difference in growth of trees on land not eroded and on land which has been but slightly eroded in the

FIG. 6. *A common type of erosion in the north and central peach sections.*

same orchard. On hillsides with an 8 to 10 per cent slope where no effort has been made to conserve water and soil, it is rather interesting to note how rapidly the trees die compared with trees on less abrupt hillsides. Data to show the comparative tree losses on such locations are given in Table 3. The figure given for tree

TABLE 3
EFFECT OF DEGREE OF SLOPE ON LONGEVITY OF PEACH TREES

	2-3 PER CENT SLOPE		8-10 PER CENT SLOPE	
	number	*per cent*	*number*	*per cent*
Total number of trees	557	100.0	735	100.0
In good condition	428	76.9	411	55.9
Missing	63	11.3	174	23.8
Replants	53	9.5	81	11.0
Winter injury	3	0.5	18	2.4
Borers	3	0.5	3	0.4
Erosion	6	1.1	48	6.5
Other causes	1	0.2	0	0.0

losses due to erosion are for trees actually killed by gully erosion and do not take into account trees which are not making the growth that they should because of sheet erosion. Excavations made of the root systems of 4- and 5-year-old trees grown in a Cecil sandy clay loam (2), the typical soil of the central Georgia peach section, show that over 90 per cent of the root system of peach trees is located in the first 18 inches of soil. This fact alone evidences the need of using good judgment in orchard practices to prevent losses of soil through erosion if long-lived orchards are to be realized.

PRUNING. More and more growers and research men alike are beginning to believe that peach tree pruning has been greatly overdone. It is not definitely known whether this heavy pruning affects the longevity of the peach, but it is known from studies made in central Georgia (2) that it greatly restricts root development and penetration of the soil mass. It is assumed that any factor which restricts root growth will, under the climatic conditions existing throughout the Peach Belt, limit the length of life of the tree.

SOILS. These studies indicate that particular attention should be given to soils in which peach orchards are to be planted. There is a wide variation in growth response favorable to tree longevity which seems on observation to be correlated with soil type, its inherent fertility, and its erodable condition. The problem of soil drainage except in very localized areas is not of as great importance in Georgia as in some sections of the country. The prevailing high temperatures prevent to a large extent waterlogging of the soil which might occur in regions of lower mean temperatures and higher rainfall. Most of the soils of the 3 areas studied have sufficient stone and gravel interspersed in the clay to make it fairly permeable to air and rainfall. There are in many orchards localized areas in which it is impossible to get a stand of trees. This failure in many instances is associated with unfavorable physical characteristics of the soil. For example, a clay soil which does not contain much sand or small gravel does not usually grow a vigorous stand of trees and in extreme cases no stand at all. In the north Georgia section the soil is well adapted to peaches, especially on the rolling hills. If control of erosion is effected on these hills, there is not much reason why this area could not be a heavy producer of peaches for a long time to come.

OTHER FACTORS OF LESSER IMPORTANCE AFFECTING LONGEVITY

PHONEY DISEASE. It was once thought that this disease would become an important factor affecting the longevity of the peach, especially in south Georgia. Due to excellent eradication work carried out each year, the losses from this disease have been minimized. Table 4 shows the total number of trees and the num-

TABLE 4

NUMBER OF TREES FOUND INFECTED WITH PHONEY DISEASE IN THE NORTH, CENTRAL, AND SOUTH PEACH SECTION[3]

COUNTIES	TREES							
	1938		1939		1940		TOTAL	
	INSPECTED	INFECTED	INSPECTED	INFECTED	INSPECTED	INFECTED	INSPECTED	INFECTED
NORTH GEORGIA PEACH SECTION								
Habersham	173,242	3	177,025	2	107,376	2	457,643	7
Jackson	145,886	18	146,829	31	132,542	12	425,257	61
	319,128	21	323,854	33	239,918	14	882,900	68
CENTRAL GEORGIA PEACH SECTION								
Coweta	389,355	916	434,537	1,042	407,954	442	1,231,846	2,400
Jasper	240,068	1,576	230,085	925	227,909	671	698,062	3,172
Jones	568,303	2,835	524,589	1,255	459,081	1,892	1,551,973	5,982
Meriwether	1,064,870	4,146	1,129,395	5,371	1,114,386	3,178	3,308,651	12,695
Pike	371,867	1,127	379,641	1,274	339,176	896	1,090,684	3,297
Spalding	218,488	1,021	201,507	723	27,887	40	447,882	1,784
Upson	737,635	3,633	758,879	3,737	773,893	3,160	2,270,407	10,530
	3,590,586	15,254	3,658,633	14,327	3,350,286	10,279	10,599,505	39,860
SOUTH GEORGIA PEACH SECTION								
Crawford	433,640	5,028	463,413	3,322	490,865	4,146	1,387,918	12,496
Houston	527,953	11,463	565,742	9,351	570,490	13,946	1,664,185	34,760
Macon	646,435	27,371	704,205	7,437	727,177	21,002	2,077,817	55,810
Peach	674,676	12,283	753,686	7,745	700,951	8,772	2,129,313	28,800
Bibb	42,000	669	397,775	1,050	26,500	583	466,275	2,302
	2,324,704	56,814	2,884,821	28,905	2,515,983	48,449	7,725,508	134,168

[3]These data obtained from the Bureau of Entomology and Plant Quarantine.

ber of trees infected for the period 1938-1940. Summarizing these data by sections for the 3-year period, 1938-1940 inclusive, the north Georgia peach section showed 68 infected trees out of 882,-900 or .008 per cent, the central Georgia peach section had 39,860 out of 10,599,505 or 0.38 per cent, while in the south Georgia peach section where the disease is most prevalent, there were 134,168 infected trees out of a total of 7,725,508 inspected trees or 1.74 per cent. These figures were obtained from the Bureau of Entomology and Plant Quarantine.

CROWN GALL. Crown gall was found commonly in the orchards examined. It is not often the sole cause of death, but it is usually a contributing factor. It occasionally causes serious economic loss with young trees, especially in those orchards where careless cultivation has caused wounding of the trees at the ground level.

NEMATODES. Nematodes cause the loss of but few trees in central and north Georgia where the soils are heavy. In south Georgia where the lighter-textured soils are found, much more nematode injury occurs. In the future, with the reduction in cost of the Shalil and Yunnan nematode-resistant stocks, unless some unforeseen difficulty arises, more orchards will be set to trees budded on these stocks, and nematode injury should become a less important factor in limiting the life of peach trees.

PROLONGED DORMANCY. In the southern part of Georgia, prolonged dormancy or delayed foliation due to insufficient hours of cold below 45° F. is a factor in longevity with some varieties. It should be pointed out that conditions favorable for prolonged dormancy of peach trees are of unusual rather than of common occurrence in most of the commercial peach-growing area of Georgia. The cumulative effect where such conditions occur frequently undoubtedly results in a shorter life span of the trees, but the infrequency of delay in foliation of peach trees over most of the commercial Peach Belt of Georgia relegates this condition to a role of comparatively minor importance as a factor affecting longevity.

VARIETIES. It is recognized by most growers that trees of some varieties are longer-lived than others. The Mayflower and Early Rose varieties are generally considered weak trees and are more susceptible to winter injury than are Elberta and some other varieties. This generalization is borne out by figures obtained in this study. In an 11-year-old orchard of an original 5,000 Early Rose trees, 3,050 or 61 per cent were living; of 5,000 Georgia Belle trees, 4,300 or 86 per cent were in good condition; and of 9,781 Elberta trees, 8,118 or 83 per cent were alive.

DISCUSSION

The susceptibility of trees to injuries of various types and their vitality after such injury is chiefly dependent on the tree condition when subjected to such rigors. Climatological data seem to furnish the most plausible explanation for the more favorable tree

condition and the longer span of life of peach trees in the more northern sections.

The south Georgia peach section had an average mean temperature over the 10-year period 1930-1940 of 4.7° F. higher than that of north Georgia. During the critical months of the growing season, April through September, the average temperature is 4.2° F. higher in south than in north Georgia. The average annual rainfall for the 10-year period is 13.85 inches more in the north section than in the south, while during the period of greatest water use, April through September, 4.53 inches more rainfall fell in north Georgia. With the lower mean temperatures which result in decreased transpiration and evaporation rates, together with the greater annual rainfall in north Georgia, the orchards in this district where some effort has been made to prevent excess runoff enter the season of hot weather with a greater reservoir of water and maintain this reserve better than the orchards farther south.

In the peach-growing sections of the northern states and even in north Georgia where high temperatures do not prevail over so extensive a period, longer-lived orchards are to be expected. In north Georgia where the moisture supply is more nearly adequate at all times, even fairly badly injured trees live and maintain production over several years as is true in some northern states. In south Georgia the demand for water is so heavy that injury to one side of the tree soon results in its death. Under these conditions of high temperature and oftentimes inadequate water supply, any injury no matter how slight quickly weakens the tree, making it even more susceptible to winter injury and the attacks of insects and diseases.

SUMMARY

1. Winter injury in its various forms is the principal factor affecting longevity of peaches in Georgia. Fertilizer applications sufficient to maintain a normal, vigorous growth aid materially in its prevention.

2. The peach borer is still a factor in limiting the life of peach trees in the different peach sections of the state. The greater use and more careful application of present-day control methods are reducing the toll taken by this insect.

3. Every effort should be made to control erosion in peach orchards by such means as contour planting, cover crops, and terraces. A reduction in soil and water losses usually means a decrease in tree losses.

4. Only those varieties which are hardy and yet of good quality should be planted. The planting of varieties which are known to be short-lived due to susceptibility to winter injury or some other factor should be avoided.

5. New plantings should only be made on soil in which the trees root deeply. Too steep slopes are not desirable because of increased cost of erosion control and ordinary orchard operations. Southwest slopes, particularly in the north Georgia peach section, are not desirable because of danger of winter sunscald.

6. Heavily pruning peach trees is definitely a poor orchard practice. This type of pruning restricts the development of the root system which in turn probably limits the life of the tree.

7. Trees affected with the phoney disease should be removed from the orchard and destroyed as should also trees affected with crown gall. Care in cultivation will aid in prevention of crown gall.

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